C) AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of claims:

Claims 1 - 10 [Cancelled]

11. [Currently Amended] A photonic integrated circuit, comprising:

an input/output interface arranged on a substrate comprising a plurality of waveguides for simultaneously inputting at least one signal to and outputting at least one signal from the photonic integrated circuit for demultiplexing a multiplexed optical signal in to n different constituent wavelengths and for combining n input optical signals composed of n different constituent wavelengths in to a multiplexed signal;

a slab waveguide arranged on the substrate having a first end and a second end, the first end coupled to the plurality of waveguides of the input/output interface to focus the at least one input signal to the second end, and the second end coupled to ~~the array of waveguides~~ an array waveguide, for focusing the at least one output signal to the input/output interface through the first end;

~~an~~the array waveguide arranged on the substrate comprising a plurality of waveguides for coupling the one or more input signals, separating the one or more input signals into the n different constituent wavelengths and focusing the n different constituent wavelengths back on to the slab waveguide first end coupling to the input/output interface, the plurality of waveguides of the array waveguide being optically coupled at one end with the second end of the slab waveguide, and terminated at ~~the opposing end~~ ~~by the~~ an opposing end of the array waveguide by a reflective mirror, each waveguide of said ~~plurality of arrayed waveguides~~ array waveguide having a predetermined path difference between successive waveguides; and

the reflective ~~a reflective~~ mirror integrally disposed and formed along an edge of the integrated circuit at the opposing end of the array waveguide for reflecting the one or more signals incident on it from the array waveguide back into the array waveguide.

12. [Previously presented] The photonic integrated circuit as set forth in claim 11, wherein any one of the
waveguides of the input/output interface plurality of waveguides provides an input channel and a different waveguide of the input/output interface plurality of waveguides provides an output channel.

13. [Previously presented] The photonic integrated circuit as set forth in claim 11, wherein any one of the waveguides of the input/output interface plurality of waveguides provides an input channel and the remaining waveguides of the input/output interface plurality of waveguides are automatically output channels.

14. [Previously presented] The photonic integrated circuit as set forth in claim 11, wherein any one of the waveguides of the input/output interface plurality of waveguides provides an output channel and the remaining waveguides of the input/output interface plurality of waveguides are automatically input channels.

15. [Previously presented] The photonic integrated circuit as set forth in claim 13, wherein the one waveguide of the input/output interface is preselected as an input channel.

16. [Previously presented] The photonic integrated circuit as set forth in claim 14, wherein the one waveguide of the input/output interface is preselected as an output channel.

17. [Previously presented] The photonic integrated circuit as set forth in claim 11 wherein one of the plurality of waveguides of the input/output interface is an input and the remainder of the waveguides form output channels, and the number of output channels is n wherein n is selected from one of the group of integer numbers consisting of 4, 8, 12, 16, 24, 32, and 48.

18. [Currently Amended] The photonic integrated circuit as set forth in claim 11 wherein one of the plurality of waveguides of the input/output interface is an output and the remainder of the waveguides form input channels, and the number of input channels is n wherein n is selected from one of the group of integer numbers consisting of 4, 8, 12, 16, 24, 32, and 48.

19. [Previously presented] The photonic integrated circuit as set forth in claim 11 wherein n waveguides of the plurality of input/output interface waveguides are spaced at a predetermined distance and form n channels.

20. [Previously presented] The photonic integrated circuit as set forth in claim 19 wherein the predetermined distance is selected from the group consisting of 0.25 nanometers, 0.4 nanometers, 0.8 nanometers, 1.6 nanometers, 4 nanometers, and 5 nanometers.

21. [Previously presented] The photonic integrated circuit as set forth in claim 11 wherein n waveguides of the plurality of input/output interface waveguides form n channels, and the channel frequency is a predetermined frequency.

22. [Previously presented] The photonic integrated circuit as set forth in claim 11 wherein the predetermined channel frequency is selected from the group consisting of about 31 GHz, and 50 GHz, 100 GHz, 200 GHz, 500 GHz, and 624 GHz.

23. [Currently Amended] A second-phase photonic integrated circuit comprising

a photonic integrated circuit, the photonic integrated circuit comprising:

an input/output interface arranged on a substrate comprising a plurality of waveguides for simultaneously inputting at least one signal to and outputting at least one signal from the photonic integrated circuit for demultiplexing a multiplexed optical signal in to n different constituent wavelengths and for combining n input optical signals composed of n different constituent wavelengths in to a multiplexed signal;

a slab waveguide arranged on the substrate having a first end and a second end, the first end coupled to the plurality of waveguides of the input/output interface to focus the at least one input signal to the second end, and the second end coupled to ~~the array of waveguides~~ <u>an array waveguide</u>, for focusing the at least one output signal to the input/output interface through the first end;

~~an~~<u>the</u> array waveguide arranged on the substrate comprising a plurality of waveguides for coupling the one or more input signals, separating the one or more input signals into the n different constituent wavelengths and focusing the n different constituent wavelengths back on to the slab waveguide first end coupling to the input/output interface, the plurality of waveguides of the array waveguide being optically coupled at one end with the second end of the slab waveguide, and terminated at ~~the opposing end~~ ~~by the~~ <u>an opposing end of the array waveguide by a</u> reflective mirror, each waveguide of said ~~plurality of arrayed waveguides~~ <u>array waveguide</u> having a predetermined path difference between successive waveguides; and

<u>the reflective</u> ~~a reflective~~ mirror <u>integrally</u> disposed <u>and formed along an edge of the integrated circuit</u> at the opposing end of the array waveguide for reflecting the one or more signals incident on it from the array waveguide back into the array waveguide;

and an active unit formed on the substrate, the active unit connected to the photonic integrated circuit by a waveguide interconnect means.

24. [Currently Amended] The second-phase photonic integrated circuit as set forth in claim 23, wherein the active unit is a waveguide amplifier block, and the waveguide amplifier block is configured for ~~connecting~~ <u>connection to</u> an external pump laser ~~with the waveguide amplifier block~~ through a <u>first</u> wave guide interconnect.

25. [Previously presented] The second-phase amplified photonic integrated circuit as set forth in claim 23, wherein the active unit is selected from the group consisting of laser diodes, VCSELS, detector arrays and electro-optic modulators, receiver, transmitter, transceivers, and transponders.

26. [Previously presented] The second-phase amplified photonic integrated circuit as set forth in claim 23, wherein the amplifier block is comprised of a material that absorbs light in the 890 nanometer and the 1480 nanometer regions and emits light in the 1310 nanometer and 1550 nanometer regions.

27. [Previously presented] The second-phase photonic integrated circuit as set forth in claim 26 wherein the amplifier block material is selected from one of the following: erbium doped dendrimer or glass.

28. [Previously presented] The second phase amplified photonic integrated circuit as set forth in claim 23, also comprising a signal processing unit coupled to the photonic integrated circuit for electro-optically processing the input and output signals.

29. [Previously presented] The second-phase amplified photonic integrated circuit as set forth in claim 28, wherein the signal processing unit is a modulator block.

30. [Previously presented] The second-phase amplified photonic integrated circuit as set forth in claim 29 also having an external connecting means for interconnecting the modulator block to an external optical device.

31. [Previously presented] The second-phase amplified photonic integrated circuit as set forth in claim 29 wherein the modulator block comprises a plurality of n electro-optical elements.

32. [Currently amended] The second-phase amplified photonic integrated circuit as set forth in claim 29 wherein the modulator block is connected to[,] the photonic integrated circuit through a first waveguide interconnect, and the photonic integrated circuit is connected to the active unit ~~are connected via~~ through a second waveguide interconnect.

33. [Currently amended] The photonic integrated circuit as set forth in claim 11 wherein the photonic integrated circuit is fabricated by a monolithic means.

34. [Currently amended] The second phase photonic integrated circuit as set forth in ~~claim 33~~ claim 23 wherein the photonic integrated circuit and the active unit are fabricated by a monolithic means.

35. [Currently Amended] The second phase photonic integrated circuit as set forth in claim 28 wherein the photonic integrated circuit, the active unit and the ~~modulator block~~ signal processing unit are fabricated by a monolithic means.

36. [Cancelled] A method of fabricating a photonic integrated circuit comprising the steps of:

providing a substrate having a predetermined refractive index;

depositing a first cladding layer on the substrate, the cladding layer having a refractive index that is less than the refractive index of the substrate;

depositing a core layer on the first cladding layer, the core layer having a refractive index greater than the refractive index of the first cladding layer; then

masking the core layer in a predetermined number of locations with a pattern defining a plurality of square ridges, the square ridges defining a plurality of core portions of a waveguide; then

etching the core layer by an etching process to form sharp walled ridges of the plurality of core portion, wherein each of the core portions are characterized by a predetermined path length that differs uniformly from the path length of the neighboring core portion; then

depositing a second cladding layer on the etched core layer, the second cladding layer being comprised of the same material of the first cladding layer and having a refractive index identical to the refractive index of the first cladding layer; wherein the second cladding layer is the same thickness as the core layer and occupies one or more spaces in the etched core layer between the sharp walled ridges, the second cladding layer being contiguous with the first cladding layer between the core portions; then

depositing a third cladding layer on the second cladding layer and core layer, the third cladding layer being made comprised of the same refractive same material of the first cladding layer and having a refractive index identical to the refractive index of the first cladding layer; then

depositing a top layer of a common material on the third cladding layer, the common material providing structural support for the photonic integrated circuit;

providing a mirror surface portion comprised of a highly reflective metal on a side of the photonic integrated circuit adjacent one end of each of the one or more core portions.

37. [Cancelled] The method of claim 36, wherein the substrate being characterized by a refractive index in the range of 3.4 to 3.5; the first, second and third cladding layers being characterized by a refractive index in the range of about 1.45 to about

1.47; and the core layer being characterized by a refractive index in the range between 0.5% and 2.0% greater than the refractive index of the cladding layers.

38. [Cancelled] The method of claim 37, wherein the thickness of the cladding layers and the core layer having a thickness of about 5 micrometers to 6 micrometers, and the one or more core portions having a substantially square cross section.

39. [Cancelled] The method of claim 36, wherein the predetermined path length difference is between 128 and 150 micrometers.

40. [Cancelled] The method of claim 36, wherein the highly reflective metal is gold, and the method further comprises the steps of masking one side of the photonic integrated circuit and evaporating a layer of gold on the masked side of the photonic integrated circuit.

41. [Cancelled] The method of claim 40 wherein the thickness of the mirror surface portion is approximately 10 micrometers.

42. [Currently Amended] The photonic integrated circuit as set forth in claim 11, also comprising a second-phase integration combining the ~~phontonic~~ photonic integrated circuit with an amplification device.

43. [Previously presented] The photonic integrated circuit as set forth in claim 42, also comprising a third-phase integration combining the photonic integrated circuit with an amplification device and a signal processing device.